

**RESEARCH ON WILDFIRE HAZARD REDUCTION  
IN PONDEROSA PINE ECOSYSTEMS  
AT GRAND CANYON NATIONAL PARK**

**COCONINO COUNTY • ARIZONA**

**Summary**

The condition of Grand Canyon National Park's (GRCA) ponderosa forests has been greatly altered since the late 1800s. Historically, small numbers of large old ponderosa pines dominated these forests and frequent, low intensity fires burned duff and seedlings from the forest floor but left most of the mature trees unharmed. This changed when livestock grazing and intentional fire suppression interrupted the natural fire regime. Today, extensive areas of the forest are dominated by dense stands of small trees making them more susceptible to disease, insect infestation, and high intensity wildfires. Carefully monitored, long-term experiments are needed in order to evaluate the short- and long-term effects of reintroducing fire to ponderosa pine ecosystems after long periods of fire exclusion. Through carefully designed scientific studies comparing before-and-after treatments, and long-term monitoring of treatment and control sites, the Park will gain information that can be used to refine fire management practices and preserve the Park's forests.

This Environmental Assessment/Assessment of Effect (EA) analyzes the impacts of three fire management research alternatives at GRCA: A) a no-action alternative; B) the alternative based on a research design developed by Northern Arizona University; and C) the agency preferred/environmentally preferred alternative. Impacts to natural, cultural, socioeconomic, and wilderness resources, visitor use, and Park operations are described in this document. The preferred action is a research project designed to test four management prescriptions on two small-scale (80-acre) experimental blocks. Fire suppression and current fuels reduction approaches using prescribed fire (fire alone) would be compared with two fuels reduction approaches that involve thinning of small-diameter trees followed by prescribed burning. The preferred action is a revised set of treatments designed to address public comments received on an EA that was released for public review in January 1999, entitled *Grand Canyon Forest Restoration Research*. The treatments described in the preferred action focus on wildfire hazard reduction and resource protection, specifically for preserving old trees. Information gained through this research would enable the Park to reevaluate and refine current fire management practices and guide future management decisions, including the Park's Fire and Resource Management Plans. We expect that any thinning prescriptions developed as a result of this research would be applied selectively (specifically at wildland-urban interfaces, burn unit perimeters, and Park boundaries, and to protect sensitive natural and cultural resources), and would not be applied over broad areas of the Park.

## PURPOSE AND NEED FOR THE PROPOSED ACTION

Scientists generally agree that a frequent, low intensity fire regime played a significant role in maintaining relatively open conditions in Southwestern ponderosa pine (*Pinus ponderosa*) forests by controlling tree population densities and forest floor litter accumulations (Cooper 1960, Kilgore 1981, Swetnam and Betancourt 1990, Covington et al. 1994, Swetnam and Baisan 1994). Human-caused changes, such as livestock grazing and fire suppression, have disrupted fire cycles and resulted in interruptions, or sudden increases, in tree population. This in turn has led to steadily increasing accumulations of fuel on the forest floor, reduced tree vigor, and conversions of vegetation from fire adapted species to fire intolerant species.

Other effects attributed to the change in the normal fire cycle include decreased understory vegetation, an increased likelihood of insect and disease outbreaks, and increased potential for and instances of high intensity wildfires. If current trends continue, large tracts of forest will be lost to disease, drought, and fire (Covington and Moore 1994, Covington et al. 1994, Covington et al. 1997b, Fulé et al. 2000). Despite the relative consensus among scientists and natural resource professionals that continuation of this situation is unwise, methodologies appropriate for returning “natural” forest function and process are the subject of considerable debate (Covington et al. 1994, Fiedler et al. 1996, Harrington 1996, Miller 1996).

As a result of long-term changes to Grand Canyon National Park’s GRCA forests, we face fire conditions that are hazardous to life, property, and sensitive resources. We are working to address these conditions through the Park’s ongoing fire program. As explained in GRCA’s Resource Management Plan (USDI National Park Service 1997) “Fire research initiated in the 1970s identified more clearly the adverse effects caused by suppression, and in 1978 a management plan was developed and approved allowing for the first time fires to burn under an established set of conditions. The Yellowstone fires in 1988 ushered in a new era, new fire management policies, and considerable funding both for suppression and prescribed burning. Since that time there has been an increase in fire management staff professionalization, and development of an aggressive prescribed fire policy.”

In August 1997, National Interagency Fire Center personnel visited the Park to evaluate fire hazards and offer suggestions. The report from that visit (Botti et al. 1997) states “The park and adjacent national forest have recognized for some time that the North Rim forests have an unnaturally dense growth of understory trees due to the suppression of lightning fires and the cessation of aboriginal ignitions in the late nineteenth century. The continued encroachment of these ‘ladder’ fuels under what was naturally an open canopy of pines and firs, together with the heavy accumulation of dead and downed fuels, has created the potential for widespread crown fires that will further disrupt the natural ecosystem and endanger public safety, cultural resources, park facilities, and market resources on the Kaibab National Forest....It has yet to be proven that either prescribed burning alone or in combination with mechanical treatments can correct the fuels problem quickly enough to prevent large, catastrophic wildfires. However the risks of no action far outweigh the risks of prescribed fire or mechanical thinning. There is no doubt that without intervention to modify the fuels complex, an unnatural and catastrophic wildfire will sweep across tens of thousands of acres on the North Rim within the next few years.”

During the summer of 2000, severe and extensive fires occurred in many Western states, leading the President to ask the Secretaries of the Interior and Agriculture to prepare an analysis of needed actions and requirements. Their report “...focused on several key points: restoring landscapes and rebuilding communities, undertaking projects to reduce risks, working directly with communities, and establishing accountability. The Congress expressed its support with substantial new financial resources...along with direction for aggressive planning and implementation to reduce risks of wildland fire in Wildland Urban Interface areas” (USDI 2001).

The purpose of this research is to compare four fire management approaches in GRCA. The proposed treatments are aimed at safely managing hazardous forest fuels while protecting old trees and other resources. There is a constant need for new management applications for reducing and containing undesirable wildfire (Nichols et al. 1994). This research would compare prescribed fire alone and fire suppression to two levels of

thinning of small-diameter trees followed by prescribed burning. Furthermore, this research would provide information on treatments designed to meet both fire management and ecological objectives for safely returning more natural fire regimes to the landscape. It is unlikely that any single method would meet all objectives for hazard fuels reduction and preservation of vegetation, wildlife habitat, air quality, and wilderness. This research would not establish Park fire management policies, which is done through development of fire management plans. Rather, this research would help refine our current practices of thinning and burning and would evaluate methods for protecting sensitive resources. The experiment would be successful if it provides information on both wildfire hazard reduction and resource benefits, specifically information on: effects on fuel loads (both live fuels and coarse woody debris); progression of current conditions toward desired future conditions (see Appendix A); and changes in the condition of currently stressed large, old trees, of shrubs and herbs of the understory, and of exotic plant species.

Results of this research would be used to evaluate and refine techniques to reduce hazardous fuels in pine/oak and pine/fir communities for:

1. wildland-urban interface fuel treatments;
2. preparation of defensible perimeters for burn units;
3. reducing wildfire spread beyond Park boundaries;
4. protection of sensitive natural and cultural resources.

The scope of this research project does not include sub-alpine mixed conifer forests or pinyon-juniper woodlands. We also do not expect thinning to be applied over broad areas of the Park in the future.

GRCA's General Management Plan (USDI National Park Service 1995a) called for studies to determine the natural fire regime for plant communities and the effects of fire exclusion and prescribed fire on Park wildlife and vegetation communities. Because of different management histories, experimental data from surrounding areas are not as useful as site-specific data obtained within the Park. This is a National Park Service (NPS) project. Northern Arizona University (NAU) is assisting the Park by helping to evaluate the effects of these treatments on vegetation and forest fuels. To help the Park to begin to address forest conditions at GRCA, NAU's College of Ecosystem Science and Management submitted a draft research proposal entitled *Grand Canyon Forest Ecosystem Restoration* to the United States Department of Interior's (USDI) Fire Coordination Committee. The Fire Coordination Committee's Research Working Team granted funding in the amount of \$925,000 on February 20, 1997 to proceed with two distinct phases of the proposal.

In the first phase, NAU's 1997 research proposal included study of fire history and the historic range of natural variability of forest vegetation and structure for two 3,000-acre study units on the North and South Rims of GRCA. This portion of the research was permitted under a categorical exclusion (see Appendix B) and has been completed.

NAU's 1997 research proposal also included a second phase that would test three restoration treatment methodologies: burning alone, thinning followed by burning, and no treatment. The Park distributed the proposal for extensive peer review and worked with NAU to revise the proposal to include a fourth treatment, minimal thinning, followed by burning (Covington et al. 1997a). NAU's revised research proposal was the basis for Alternative "B". An EA based on NAU's revised research proposal, entitled *Grand Canyon Forest Restoration Research*, was also submitted for public review in January 1999.

Based on an evaluation of the comments received about the draft EA, Park staffs have developed Alternative "C". This is the agency preferred and environmentally preferred alternative (preferred action). Under this treatment, fewer and smaller trees would be thinned and no wood would be removed from the sites. With Alternative "C" the Park has focused on methods for protecting old trees while implementing prescribed fire. Wildfire hazard reduction and resource protection have always been inherent to the project, but this research takes a more incremental approach to fuels reduction than had been described in Alternative "B".

The advantages of Alternative “C” are that it addresses concerns related to tree thinning in parks, eliminates ecological and aesthetic damage associated with skid trails and landings, would be relevant for roadless areas, and provides a longer time period to assess initial results. Disadvantages of this approach are that treatments may need to be repeated to accomplish fuel reduction objectives, and it takes longer to assess progress. This EA evaluates the impacts of the Alternative “C” (preferred action) and compares it to Alternative “A” (no action) and Alternative “B” (see Table 1 on pages 6-7).

Specifically, the NPS proposes to complete experimental treatments on a total of 160 acres in GRCA (Covington et al. 2000a, Revised Work Plan, Appendix C). Both the North and South Rim 80-acre experimental blocks would be divided into four 20-acre experimental units. Treatments would be randomly assigned to each experimental unit. The Park’s staff would supervise the completion of all experimental treatments. The preferred experimental treatments are described below.

- 1) **Intermediate Thinning and Burning Treatment (Intermediate Treatment).** One 20-acre unit on both the North and South Rims (total of 40 acres) would undergo an intermediate treatment. Under this treatment, all trees less than 5 inches diameter at breast height (dbh, typically cited as 4.5 feet above ground level) would be cut, except those needed for replacement of lost presettlement trees. The thinning would be followed by prescribed fire treatments.
- 2) **Minimal Thinning and Burning Treatment (Minimal Treatment).** One 20-acre unit on both the North and South Rims (total of 40 acres) would undergo a minimal treatment. Under this treatment, thinning would be targeted around individual presettlement-age trees. Trees with a dbh of 5 inches or less, within a predetermined distance around all presettlement-age trees, would be cut. The maximum thinning distance is equal to the average height of the canopy within 40 feet surrounding the target tree, with a minimum of 40 feet. For example, if the average canopy height were 50 feet, thinning would extend out to 50 feet from the target tree (see Figure 1 on page 10). The thinning would be followed by prescribed fire treatments.
- 3) **Burn-only Treatment.** One 20-acre unit on both the North and South Rims (total of 40 acres) would undergo a burn-only treatment. No trees on these units would be cut except when required to mitigate specific hazards to safe prescribed burning. The units would only be treated with prescribed fire.
- 4) **Control.** One 20-acre unit on both the North and South Rims (total of 40 acres) would serve as a control. Under this treatment no trees would be thinned, and fire would continue to be excluded from the unit.

Alternative “C” (preferred action) differs from Alternative “B” on the following points:

1. A 5-inch limit would be placed on trees to be thinned. A small diameter limit would: enable all thinned material to be left on site as slash, be applicable to roadless areas, eliminate need for skid trails or landings, be more feasible with hand tools, and accomplish research objectives.
2. No wood would be utilized for any purpose or removed from the experimental sites. The thinned trees would be broadcast burned or burned in piles. GRCA fire staff would make a determination of what technique would be used to safely burn this slash.
3. Two years after burning, the effectiveness of the 5-inch limit and other aspects of the treatments would be assessed.
4. No mechanized equipment would be used for thinning on the North Rim site, proposed for wilderness status.
5. No road improvements, skid trails, or landings would be needed or constructed.
6. Litter and duff would be raked away from presettlement trees in the two thinning treatments, but not in the burn-only treatment. This would allow the burn-only treatment to serve as a better comparison to current management practice.

## PROJECT LOCATION

This project is located in Grand Canyon National Park, Coconino County, Arizona (see Maps 1 & 2 on pages 8-9).

## PUBLIC COMMENT

To view the EA, including references and appendices, access the following web site:  
*[www.nps.gov/grca/forest/](http://www.nps.gov/grca/forest/)*.

If you wish to comment on the EA, you may mail comments to this address:

Joseph F. Alston, Superintendent  
Attention: Sara White, Compliance Officer  
Wildfire Hazard Reduction Research  
Grand Canyon National Park, P.O. Box 129  
Grand Canyon, AZ 86023

This EA will be on public review for 45 days. The purpose of this comment period is to seek comments and additional information that might pertain to the three alternatives presented. Substantive public and agency information and comments received through this comment period will be considered in the final decision document. Please note that names and addresses of people who comment become part of the public record. **If you wish us to withhold your name and/or address, you must state this prominently at the beginning of your comment.** We will make all submissions from organizations, businesses and individuals identifying themselves as representatives or officials of organizations or businesses available for public inspection in their entirety.

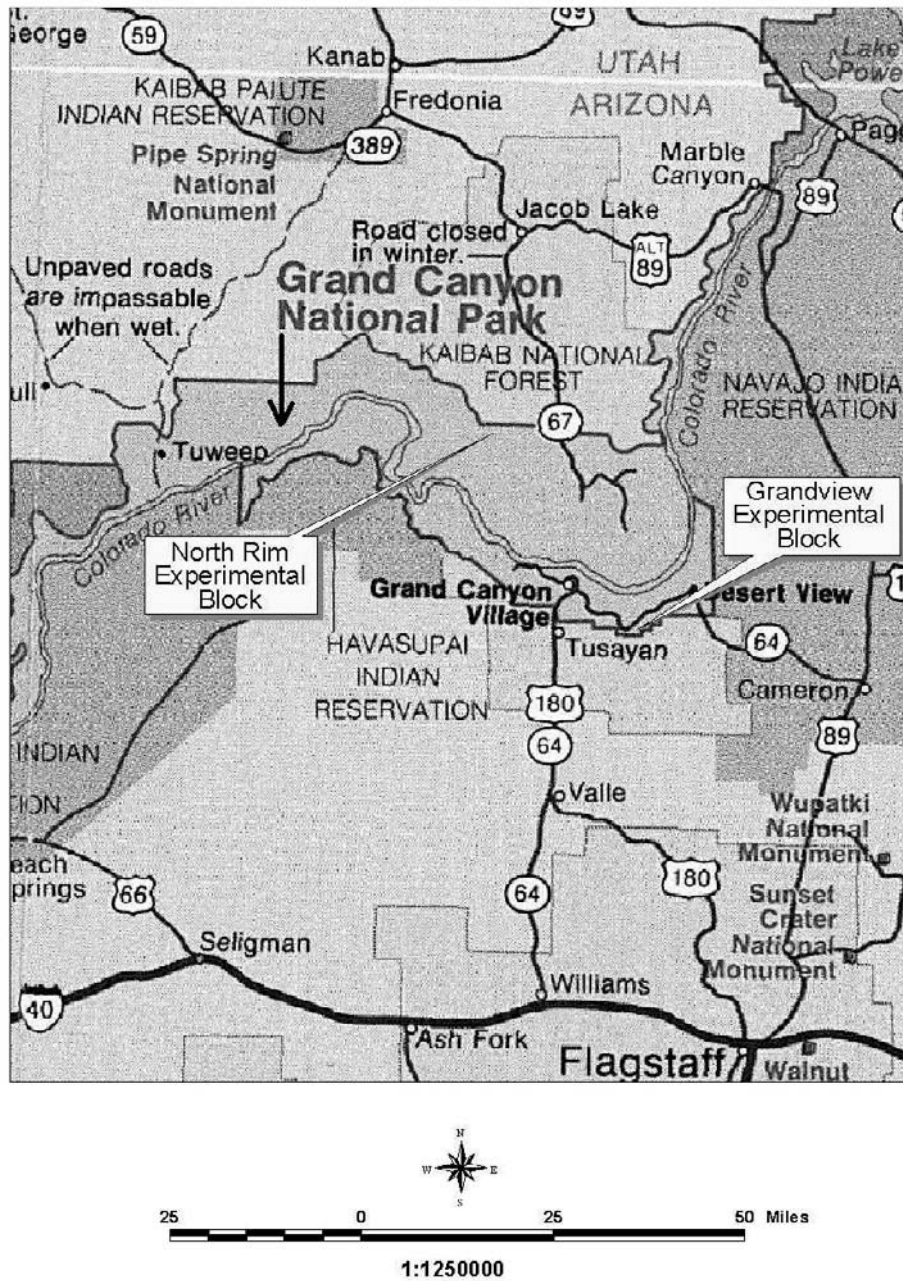
**Table 1.** Comparison of treatments in the three Wildfire Hazard Reduction Research alternatives.

		ALTERNATIVE "A"	ALTERNATIVE "B"	ALTERNATIVE "C" – PREFERRED ACTION
CONTROL	methods	Not tested under this alternative.	Clear fireline around control unit and experimental block with power tools on North Rim and at Grandview.  See EA §II.B.4, page 13.	Clear fireline around control unit and experimental block with hand tools on North Rim and power tools at Grandview.  See EA §II.C.4, page 17.
	activities	Fire management (prescribed fire, suppression) according to GRCA Fire Management Plan 1992 or revision	No thinning No burning Fire exclusion (firelines to prevent wild and prescribed fires)	No thinning No burning Fire exclusion (firelines to prevent wild and prescribed fires)
	thinning	None	None	None
BURN-ONLY	methods	Not tested under this alternative.	See EA §II.B.3, page 13.	See EA §II.C.3, page 17.
	activities	Fire management (prescribed fire, suppression) according to GRCA Fire Management Plan 1992 or revision	Prescribed fire according to GRCA Fire Management Plan 1992 or revision	Prescribed fire according to GRCA Fire Management Plan 1992 or revision
	thinning	None	None	None
MINIMAL THINNING/ MINIMAL TREATMENT	methods	Not tested under this alternative.	Mark "save" trees with flagging and paint spot at ground level Thinning trees via chainsaws  Trim stumps close to ground Skid logs with horse teams Rake duff from old trees and snags before burning Cut wood <6" diameter into 2-4' lengths; burn slash on site Remove logs with small trucks on open public roads See EA §II.B.2, pages 11-13.	Mark "save" trees ≤5" dbh with flagging and paint spot at ground level Thinning via chainsaws at Grandview and hand tools on North Rim Trim stumps close to ground No skidding or log removal Rake duff from old trees and snags before burning Cut wood into 2-4' lengths; burn slash on site Transport work crews w/ small trucks on open public roads See Revised Work Plan pages 30-32, EA §II.C.2, pages 15-17.
	activities	Fire management (prescribed fire, suppression) according to GRCA Fire Management Plan 1992 or revision	Thin trees < 12" dbh around target trees Thinning via chainsaws Prescribed burning following thinning Wood transferred to BIA Raking around target trees	Thin trees < 5" dbh around target trees Thinning via chainsaws at Grandview and hand tools on North Rim Prescribed burning following thinning No wood removed from experimental blocks Raking around target trees
	thinning	None	7244 trees 1-4.9" 840 trees 5-8.9" 20 trees 9-11.9"	7244 trees 1-4.9"

		ALTERNATIVE “A”	ALTERNATIVE “B”	ALTERNATIVE “C” – PREFERRED ACTION
INTERMEDIATE TREATMENT	methods	Not tested under this alternative.	Not tested under this alternative.	Same as described for Minimal Treatment (above) See EA §II.C.1 & 2, pages 14-15.
	activities	Fire management (prescribed fire, suppression) according to GRCA Fire Management Plan 1992 or revision	Not tested under this alternative.	Thin most trees <5” dbh in treatment plot (except designated replacement trees) Thinning via chainsaws at Grandview and hand tools on North Rim Prescribed burning following thinning No wood removed from experimental blocks Raking around target trees
	thinning	None	Not tested under this alternative.	5654 trees 1-4.9”*
FULL RESTORATION	methods	Not tested under this alternative.	Same as described for Minimal Thinning (above) See EA §II.B.1 & 2, pages 9-11.	Not tested under this alternative.
	activities	Fire management (prescribed fire, suppression) according to GRCA Fire Management Plan 1992 or revision	Thin trees 1-19.9” dbh in treatment plot (except Designated replacement trees) Thinning via chainsaws Prescribed burning following thinning Wood transferred to BIA Raking around target trees	Not tested under this alternative.
	thinning	None	5654 trees 1-4.9”* 1822 trees 5-8.9” 354 trees 9-11.0” 30 trees 12-15.9” (10 trees 16-19.9” – deleted when Dec. 1999 Work Plan and draft EA were developed)	Not tested under this alternative.

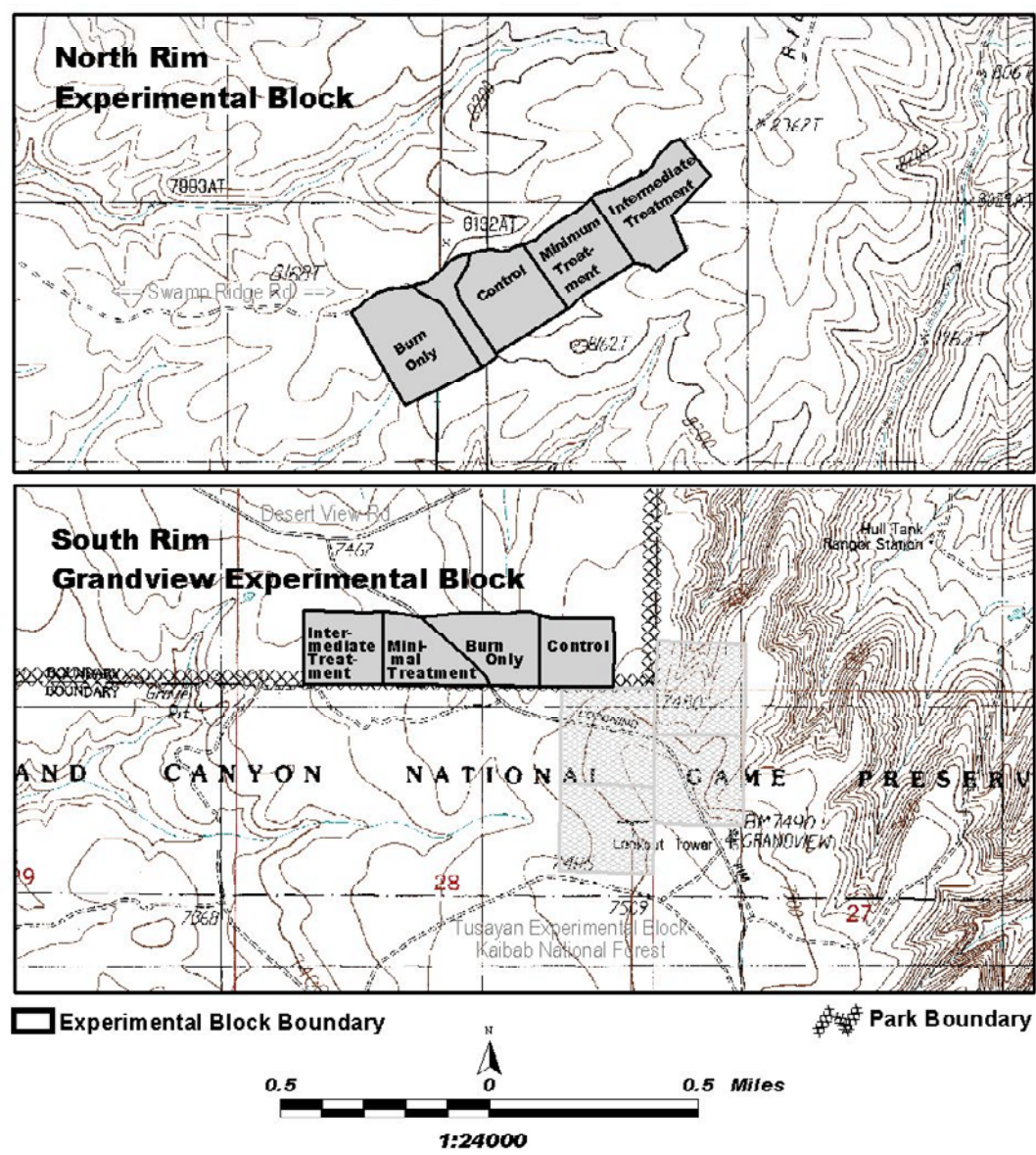
\* Fewer small trees (size class 1-4.9” dbh) would be thinned in intermediate and full restoration compared to minimal because of the randomized plot design.

**Map 1.** Wildfire Hazard Reduction Research project locations in Grand Canyon National Park.

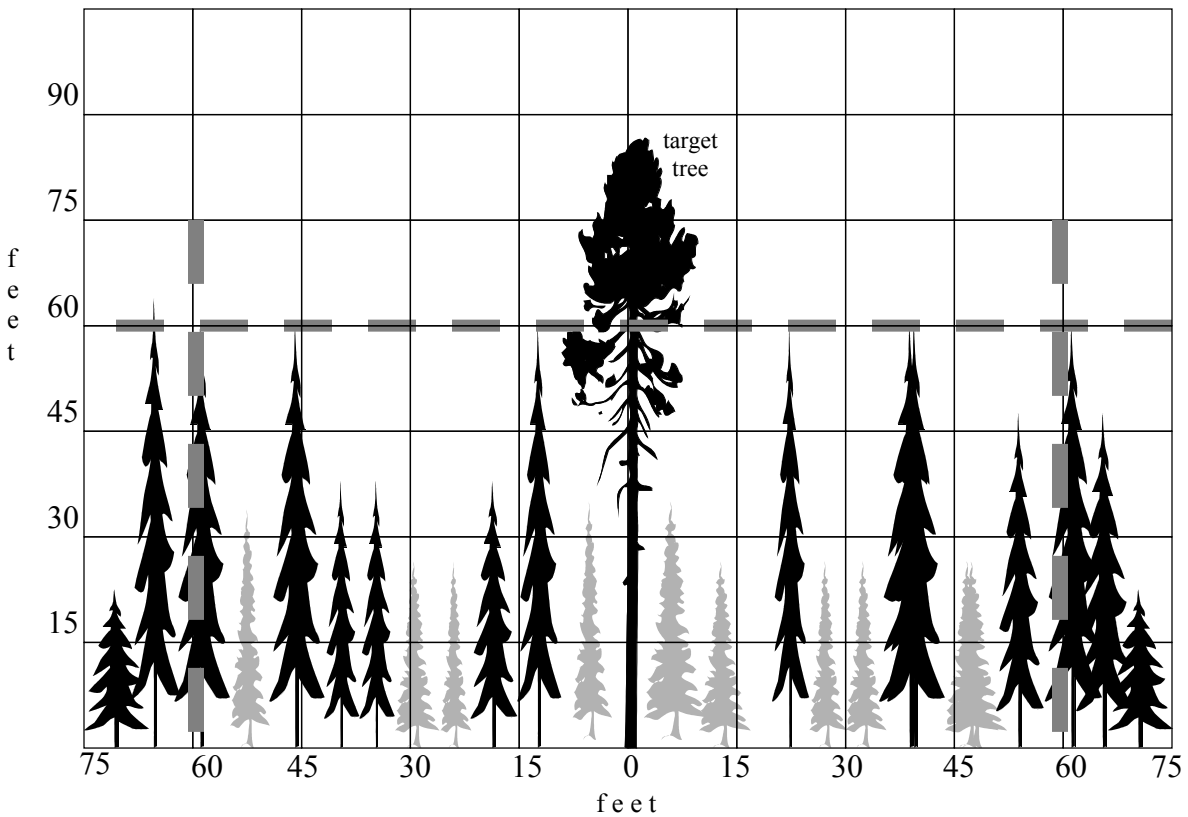




Map 2. North Rim and South Rim (Grandview) Experimental Blocks.



### Minimal Thinning Stand Cross Section Example - Preferred Action



**Figure 1.** In the minimal treatment detailed in the preferred action, trees 5 inches dbh or greater would be retained (displayed as black trees) around the target tree (depicted as the large tree at “0”). Trees less than 5 inches dbh would be thinned (displayed as gray trees) around the target tree out to a distance equal to the average stand canopy height. The horizontal and vertical dashed gray lines depict the average stand canopy height (60’) and maximum thinning distance from the target tree (60’), respectively.

Had the average stand canopy height been 45 feet, the maximum thinning distance would have been 45 feet.

The minimum thinning distance is 40 feet, thus stands with average canopy heights of less than 40 feet would still be thinned out to 40 feet.